I claim:

1. A decoder for use in a data communication system for decoding a stream of data which has been convolutionally and Reed-Solomon encoded, comprising:
a trellis decoder for performing at least one iteration for decoding the stream of data;
a Reed-Solomon decoder for further decoding the encoded stream of data after the trellis decoder is stopped, and including syndrome calculating means for calculating syndromes after every iteration of the trellis decoder; and
control means for stopping the trellis decoder from performing another iteration when all of the syndromes calculated in the syndrome calculation means are zero.

2. The decoder according to claim 1, wherein said trellis decoder is a turbo decoder.

3. The decoder according to claim 2, wherein said turbo decoder is adapted to receive a stream of data from a transmitter, which includes a first encoder with normal data input, and a second encoder with interleaved data input, the transmitter output comprising X, representing the data as input; Y_1, representing the data turbo encoded; and Y_2, representing the data interleaved and turbo encoded; and
wherein the turbo decoder comprises:
a first decoder, receiving X and Y_1 after transmission from the transmitter;
an interleaver for interleaving output from the first decoder;
a second decoder receiving output from the interleaver and Y_2, after transmission from the transmitter; and
a de-interleaver for de-interleaving output from the second decoder;
wherein output from the de-interleaver is fed back to the first decoder for another iteration through the turbo decoder unless all of the syndromes calculated in the syndrome calculation means are zero.

4. The decoder according to claim 3, wherein the Reed-Solomon decoder further comprises uncorrectable error indicator means for providing an indication, after every

iteration, that output from the turbo decoder contains errors that can not be corrected by the Reed-Solomon decoder; and

wherein said control means stops the turbo decoder from performing another iteration if the uncorrectable error indicator means indicates that output from the turbo decoder does not contain any uncorrectable errors.

5. The decoder according to claim 2, wherein said turbo decoder is adapted to receive a stream of data from a transmitter, which includes a first encoder with normal data input, and a second encoder with interleaved data input, the transmitter output comprising X, representing the data as input; Y_1, representing the data turbo encoded; and Y_2, representing the data interleaved and turbo encoded; and

wherein said turbo decoder comprises:

a first decoder, receiving X and Y_2 after transmission from the transmitter;

a de-interleaver for de-interleaving output from the first decoder;

a second decoder, receiving output from the de-interleaver and Y_1, after transmission from the transmitter; and

an interleaver for interleaving output from the second decoder for input into the first decoder for another iteration through the turbo decoder;

whereby output from the second decoder is received in the Reed-Solomon decoder without having to be de-interleaved, thereby enabling the syndrome calculations means to finish calculating syndromes at substantially the same time as the turbo decoder finishes an iteration.

6. A decoder for use in a data communication system for decoding a stream of data which has been convolutionally and Reed-Solomon encoded, comprising:

a trellis decoder for performing at least one iteration for decoding the stream of data;

a division circuit means using Reed-Solomon polynomial g(x); and

control means for stopping the trellis decoder from performing another iteration when output from the division circuit means is zero after the entire decoded data stream is shifted therein; and

a Reed-Solomon decoder for further decoding the encoded stream of data after the trellis decoder is stopped.

7. The decoder according to claim 6, wherein the Reed-Solomon decoder is bypassed if the turbo decoder is stopped when output from the division circuit is zero.

8. The decoder according to claim 1, further comprising a bit-to-byte shift register between said trellis decoder and said Reed-Solomon decoder for converting output from the trellis decoder from bits to bytes, which are input into the Reed-Solomon decoder.

9. The decoder according claim 1, wherein said control means stops the trellis decoder from performing another iteration if the trellis decoder has already performed a preset number of iterations.

10. A method for use in a data communication system for decoding a stream of data which has been convolutionally and Reed-Solomon encoded, comprising the steps of:
trellis decoding the stream of data during at least one iteration through a trellis decoder;
calculating Reed-Solomon syndromes after every iteration of the trellis decoder;
stopping the trellis decoder from performing another iteration if all of the Reed-Solomon syndromes are zero; and
Reed-Solomon decoding the encoded stream of data, after the trellis decoder is stopped, in a Reed-Solomon decoder.

11. The method according to claim 10, wherein said trellis decoding comprises turbo decoding in a turbo decoder.

12. The method according to claim 11, wherein said turbo decoder is adapted to receive a stream of data from a transmitter, which includes a first encoder with normal data input, and a second encoder with interleaved data input, the transmitter output comprising X,

representing the data as input; Y_1, representing the data turbo encoded; and Y_2, representing the data interleaved and turbo encoded; and

wherein the turbo decoding step comprises:

decoding X and Y_1 after transmission from the transmitter in a first decoder;

interleaving output from the first decoder;

decoding output from the interleaver and Y_2, after transmission from the transmitter;

de-interleaving output from the second decoder; and

sending output from the de-interleaver back to the first decoder for another iteration through the turbo decoder unless all of the syndromes calculated in the syndrome calculation means are zero.

13. The method according to claim 12, further comprising determining, after every iteration of the turbo decoder, whether the output from the turbo decoder contains errors that can not be corrected by the Reed-Solomon decoder; and

stopping the turbo decoder from performing another iteration if the output from the turbo decoder does not contain any uncorrectable errors.

14. The method according to claim 11, wherein said turbo decoder is adapted to receive a stream of data from a transmitter, which includes a first encoder with normal data input, and a second encoder with interleaved data input, the transmitter output comprising X, representing the data as input; Y_1, representing the data turbo encoded; and Y_2, representing the data interleaved and turbo encoded; and

wherein said turbo decoding step comprises:

decoding X and Y_2 after transmission from the transmitter in a first decoder;

de-interleaving output from the first decoder in a de-interleaver;

decoding output from the de-interleaver and Y_1, after transmission from the transmitter in a second decoder; and

interleaving output from the second decoder for input into the first decoder for another iteration through the turbo decoder;

whereby output from the second decoder is received in the Reed-Solomon decoder

without having to be de-interleaved, thereby enabling the syndrome calculations means to finish calculating syndromes at substantially the same time as the turbo decoder finishes an iteration.

15. A method for use in a data communication system for decoding a stream of data which has been convolutionally and Reed-Solomon encoded, comprising:
trellis decoding the stream of data during at least one iteration;
passing the stream of data through a division circuit means using a Reed-Solomon polynomial g(x);
stopping the trellis decoder from performing another iteration when output from the division circuit means is zero; and
Reed-Solomon decoding the encoded stream of data after the trellis decoder is stopped.

16. The method according to claim 15, further comprising bypassing the Reed-Solomon decoder if the turbo decoder is stopped when output from the division circuit is zero.

17. The method according to claim 10, further comprising converting output from the trellis decoder in a bit-to-byte shift register for input into said Reed-Solomon decoder.

18. The method according to claim 10, further comprising stopping the trellis decoder from performing another iteration if the trellis decoder has already performed a preset number of iterations.